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ABSTRACT

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Running head: NONVERBAL RESPONSIVENESS AND DISTANCE TEACHING

Interactive Television Instructors' Perceptions of Students' Nonverbal Responsiveness and Their Influence on Distance Teaching

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Abstract

The objective of this study was to examine the relationships between interactive television instructors' perceptions of students' nonverbal responsiveness and the influence of these perceptions on distance teaching. The study yielded three general conclusions. First, interactive television instructors' perceptions of students' nonverbal responsiveness are positively related to their impressions of students, their perceptions of their teaching effectiveness and satisfaction, their perceptions of teacher-student interpersonal relationships, and their preference for teaching in the interactive television classroom as opposed to the face-to-face classroom. The second conclusion is that instructors' perceptions of students' nonverbal responsiveness and the various teaching process variables are significantly higher in the traditional face-to-face classroom than in the interactive television classroom. The third conclusion is that receiving both visual and audible nonverbal cues via two-way audio/video versus two-way audio/one-way video delivery systems increase positive perceptions of both students and the distance teaching process.

Key Words: Distance Education, Distance Teaching, Interactive Television Instruction, Nonverbal Responsiveness, Teaching Satisfaction, Teaching Effectiveness, Teacher-Student Interpersonal Relationships, Student Perceptions.

Interactive Television Instructors' Perceptions of Students' Nonverbal Responsiveness and Their Influence on Distance Teaching

A 1995 national survey of two and four-year institutions of higher education conducted by the National Center for Educational Statistics reports that 758,640 students were formally enrolled in 25,730 distance education courses delivered to remote (off-campus) locations via audio, video, and/or computer technologies during the 1994-95 academic year (Greene & Meek, 1998). Cotton (1995) reports that "over 30 percent of higher education institutions are currently engaged in some form of distance learning and 28 percent are planning for it during 1994 and 1995" (p. 37). Traditional face-to-face classrooms are being simulated using new, interactive technologies that allow participants to see and hear each other from remote locations. Although these initiatives and the technological advancements which make them possible are being widely applauded, some distance educators continue to ask how they are to go about teaching in environments where students and teachers remain separated in time and space.

Dillon and Walsh (1992) consider the faculty to be the neglected resource in distance education. "Despite the fact that much of the literature in distance education discusses the importance of faculty, this group has been largely neglected by the research" (p. 5). Rather than focusing on the faculty, the majority of the literature has centered on distance learners' characteristics, attitudes, and learning outcomes.

The purpose of this study was to determine whether interactive television instructors' perceptions of students' nonverbal communication behaviors have any influence on their perceptions of their students and of their own satisfaction,

effectiveness, and affect for distance teaching. In the traditional face-to-face classroom, students' nonverbal reactions or responsive cues have always been a "given." This can no longer be assumed in the distance education classroom. Using various forms of mediation, distance educators teach in environments where these types of communication cues are either non-existent or filtered out (Culnan & Markus, 1987). How does this type of "altered" student nonverbal communication behavior (or the absence of nonverbal communication behavior) influence how teachers feel about teaching at a distance? How does it influence their perceptions of their own effectiveness?

Examining the influence of students' communication behaviors on teachers' attitudes and behaviors is one way of tapping into what Nussbaum (1992) referred to as the "circular nature" of teaching and learning. During distance instruction, the transactional nature of student-teacher interactions is disrupted. Instead of being transmitted through sight and sound channels as in the traditional face-to-face context, student-teacher messages are captured, recorded, and transmitted through space and time via instructional technologies where these messages, especially the nonverbal ones, appear to be altered and distorted (Culnan & Markus, 1987).

Review of Literature

Three domains of literature were reviewed to build a rationale for this study. The first examined interactive television technologies and reviewed some of the limitations of technology. The second addressed students' nonverbal communication and its effects on teaching, and the third domain examined distance teaching satisfaction.

Interactive Instructional Television

Advancements in fiber-optic, microwave, compressed video, and satellite technologies allow traditional face-to-face classrooms to be simulated for distance learners who remain separated from teachers (Palmer, Collins, & Roy, 1995). There are two major types of interactive television delivery systems that link educators to remote learners—satellite and non-satellite. Most satellite delivery systems allow for one-way video and two-way audio transmission. Most non-satellite delivery systems allow for two-way audio and video transmission.

Despite the advances in instructional delivery systems, much of the current interactive television technology falls short in delivering and replicating the face-to-face interactive environment (Culnan & Markus, 1987; Stork & Sproull, 1995). One of the main problems within the interactive television classroom is that many of the visual images remain dulled or blurred. Culnan and Markus (1987) referred to this as the cues-filtered-out perspective. They suggested that communicating in an electronically mediated environment filters out cues found in face-to-face communication. According to Culnan and Markus, mediated environments made it harder to regulate conversations, form impressions of the communication partner, and gather social context cues that are needed for competent communication.

According to Stork and Sproull (1995), current interactive video technologies limited some of the visual and audible cues that governed conversational patterns and were instrumental in impression formation. They reported that the delay in video transmission made it difficult to briefly interrupt an ongoing conversation because the

medium retarded or even prevented spontaneous dyadic conversation. Stork and Sproull reported that bodily movements and gestures tended to be blurred and jerky. Broadcast-quality video increased formality of speech, which led to greater focus on tasks that were restricted to information exchange. Side conversations during an interactive television program were interpreted as rude. Nonverbal cues, which are essential in regulating the flow of communication as well as accenting and complementing the verbal message, remained less visible (Stork & Sproull, 1995).

To assess whether or not distance teachers perceive students' nonverbal responsiveness and how instructional technologies may filter-out these important messages, the first research question asked:

RQ 1: Are there significant differences in teachers' perceptions of students' nonverbal responsiveness between traditional face-to-face and interactive television classrooms?

Students' Nonverbal Communication and Effects on Teachers

Before examining the research on students' nonverbal communication and effects on teachers, it is necessary to define what is being referred to in this study as nonverbal responsiveness. Nonverbal responsiveness has been discussed in the literature in terms of a larger construct called immediacy, which in the classroom has been associated with increases in affective learning (Andersen, 1979), perceived cognitive learning (Richmond, Gorham, & McCroskey, 1987), recall of information (Kelley & Gorham, 1988), and student motivation (Christophel, 1990). Nonverbal responsive behaviors have been shown to be indicative of immediacy. In the instructional context, Richmond et al.

(1987) identified 14 nonverbal immediacy behaviors, including smiling at students, moving around the classroom while teaching, using a variety of vocal expressions, and having a relaxed body position while talking to the class.

One reason this study remained tentative about conceptualizing nonverbal responsiveness as immediacy was that the immediacy construct has been shown to be more than responsiveness alone (Thomas, Richmond, & McCroskey, 1994). In Thomas et al. (1994), immediacy was positively related to both responsive and assertive social styles of teachers. A responsive social style was operationalized as a teacher who is perceived as being helpful, sympathetic, compassionate, responsive to others, and friendly. An assertive social style was operationalized as a teacher who is perceived as being dominant and independent, as having a strong personality and willing to take a stand. The results from this study suggested that teacher immediacy was a combination or interaction of a person's responsive and assertive social style that enhanced perceptions of physical or psychological closeness. Since the present study focused only on interactive television instructors' perceptions of students' nonverbal responsive behaviors, assertive behaviors remained outside its scope. This delineation of the immediacy construct does not, however, reduce the theoretical importance of immediacy theory and research in explaining how teachers and students perceive nonverbal behaviors and the effects of these behaviors.

Teacher impressions of students. Research suggests that teachers in the traditional face-to-face classroom form impressions of their students based on students' nonverbal responsiveness (Brooks & Woolfolk, 1987). This research remains limited to

primary and secondary education. Although the focus of the current study was on higher education, in the absence of higher education research, it was assumed that many of the following effects were salient to the distance educator working at the college level. Brooks and Woolfolk (1987) reviewed the nonverbal literature examining the effects of students' nonverbal behavior on teachers. They concluded that students' nonverbal expressions were an important source of information in the formation of teachers' impressions, attitudes, beliefs, and reciprocal behavioral expressions.

Brooks and Woolfolk (1987) reviewed three areas of nonverbal cues that affected teachers. The first centered on proxemics, or students' use of space. The second focused on students' attentiveness behaviors, and the third focused on chronemics, or students' use of time. In terms of proxemics, research indicated that proximity, or where a student sits on the first day of class (assuming student choice), affected teacher perceptions of students. Woolfolk and Brooks (1983) reported that students who decided to sit closer to the teacher were perceived to be more attentive, likable, initiating, and responsive than students who decided to sit farther away.

Students' nonverbal behaviors that teachers perceive as attentiveness (i.e., posture, eye contact, smiling) have been shown to be positively related to teachers' evaluations of students' competence, learning, teachability, and attitude (Willis & Brophy, 1974). Brooks and Woolfolk (1987) reported how the absence of attentiveness cues negatively altered teacher impressions of students. Additionally, Brophy and Evertson (1981) found that teachers attributed unhappiness or lack of cooperation to students who avoided eye contact. It has been shown that these cues impacted teacher interactions with students.

In terms of students' use of time, research indicated that the timing of a student's interruption and the rate at which a student responded to a teacher's request impacted teacher impressions (Brooks & Wagenhauser, 1980; Brophy & Evertson, 1981). Brophy and Evertson (1981) reported that students who were perceived negatively by teachers tended to make requests at inappropriate or difficult times for the teacher. Brooks and Wagenhauser (1980) indicated that teachers appeared to perceive students who responded quickly to their requests more positively.

To assess the influence that student nonverbal responsiveness has on instructors' impressions of students, the second research question asked:

RQ 2: What is the relationship between teachers' perceptions of their remote/distance students' nonverbal responsiveness and their impressions of their students?

Teaching effectiveness. According to Jenkins and Deno (1969), teachers relied heavily on student behaviors such as smiling, hand-raising, sitting straight, and behaving excitedly as ways to judge their own effectiveness. "[T]hese products (student behaviors) are likely to be an important source of feedback which selectively reinforces certain teaching activities and extinguishes others. Teaching behavior is then a function of student behavior" (p. 440). Teachers who received positive nonverbal feedback in their study found teaching more enjoyable, predicted that they would be more effective teachers, and thought that their students learned more than teachers in the negative nonverbal feedback condition.

Jecker, Maccoby, Breitrose and Rose (1964) examined how well teachers assessed students' cognitive understanding based on students' visual feedback cues. Their research suggested that when teacher judgments of student comprehension were based on visual nonverbal cues, misperceptions of students' comprehension were more likely to occur than judgments based on audible cues. Jecker et al. (1964) suggested that since increased verbal feedback remained less likely to occur as classroom size increases, teachers would benefit from learning more about students' nonverbal behaviors and how to accurately interpret such behaviors.

To assess the influence that student nonverbal responsiveness has on instructors' evaluations of their teaching effectiveness, the third research question asked:

RQ 3: What is the relationship between teachers' perceptions of their remote/distance students' nonverbal responsiveness and their evaluations of their own teaching effectiveness?

Distance Teaching Satisfaction

The third and final domain of the literature review examined distance educators' attitudes toward teaching in an electronically mediated setting. This domain also argues that teaching is a relational activity and that teacher satisfaction is partially contingent on developing relationships with students.

Attitudes. In terms of teacher attitudes and satisfaction teaching in electronically mediated environments, the research data remain inconclusive. Dillon and Walsh (1992) concluded that faculty who teach at a distance were positive toward it, and their attitudes tended to improve with experience. Clark (1993) found that faculty members remained

concerned about the quality of teacher-student interaction in the educational process. Other reported concerns included "negative quality comparisons with classroom study, concerns about socialization and affective development, and questions about learner access to resources needed for college study" (p. 30).

Stinehart's (1987) research found faculty resisting distance teaching because the process of teaching via instructional technologies was seen as lessening their control over the teaching-learning process. Stinehart (1987) suggested that faculty members' opinions on how well students learned as a result of distance instruction (the output side of the teaching-learning process) did not significantly affect their willingness to teach at a distance. "What is affecting their decision to distance teach is the input side of the teaching-learning process: how much control they perceive they have over the planning of a course as well as the delivery of the course" (p. 99).

Taylor and White (1991) found faculty members believing that distance teaching was important; however, they also found it less satisfying. Their results suggested that job satisfaction was dependent primarily on "activities associated with the act of teaching, including the opportunity to work with motivated students and the quality of interaction with students" (p. 10). Finally, Scriven (1986) reported that 25 percent of his sample would avoid distance teaching if they could. He also concluded that most academics in the sample indicated that they preferred teaching on-campus in traditional face-to-face settings than in distance instructional environments.

To assess the influence that student nonverbal responsiveness has on teaching satisfaction, the fourth research question asked:

RQ 4: What is the relationship between teachers' perceptions of their remote/distance students' nonverbal responsiveness and their teaching satisfaction?

Teaching as a relational activity. Research suggests that a satisfying teaching experience can be enhanced by an ongoing interpersonal relationship between teacher and student (Graham, West, & Schaller, 1992; Mottet, 1996, 1998a). DeVito (1986) also offers theoretical support for conceptualizing teaching as a relational activity.

Graham, West, and Schaller (1992) found that teachers who perceived themselves as interpersonally competent and immediate with their students, which included being accessible, personable, and willing to communicate, were more satisfied on the job. In a similar study, Thomas (1996) examined teacher communication behaviors that have been shown to be related to relational development and their relationships to teacher satisfaction, including control and immediacy behaviors. In her study, teachers' use of pro-social versus anti-social classroom control strategies were positively correlated with teacher satisfaction. Research suggests that pro-social communication strategies, which were based on expert and referent forms of social power, were a direct product of quality interpersonal relationships (French & Raven, 1959).

To assess the influence that student nonverbal responsiveness has on teacher-student relationships and a teacher preferring to teach in the interactive television classroom versus the traditional face-to-face classroom, the following two research questions asked:

RQ 5: What is the relationship between teachers' perceptions of their remote/distance students' nonverbal responsiveness and their perceptions of the interpersonal relationships they have with their students?

RQ 6: What is the relationship between teachers' perceptions of their remote/distance students' nonverbal responsiveness and their preference for teaching in the interactive television classroom versus the traditional face-to-face classroom?

The final research question examined how teachers' perceptions of their students, teaching effectiveness, teaching satisfaction, and teacher-student interpersonal relationships may differ as a result of instructional context. Do teachers' perceptions of their students, the interpersonal relationships they have with their students, and their evaluations of teaching effectiveness and satisfaction differ significantly between the traditional face-to-face and interactive television classrooms? In the event that teachers' affect or preference for teaching in the interactive television classroom is positively related to student nonverbal responsiveness (RQ 6), the answer to this research question will allow for closer examination and identification of the areas that are considered problematic for the distance teacher. For example, if teachers' preference for teaching in the interactive television classroom is related to their being able to see and hear remote students' nonverbal responsive behaviors, but only the teaching satisfaction variable appears to have mean values that are significantly lower in the interactive television classroom, then researchers and educators can focus their energies on resolving only the issue of distance teaching satisfaction. The seventh and final research question asked:

RQ 7: Are there significant differences in teachers' perceptions of their student impressions, teaching effectiveness, teaching satisfaction, teacher-student interpersonal relationships, and selective preference of teaching venue between the traditional face-to-face and interactive television classrooms?

Method

Sample

The sample for this study included 157 (males = 87, females = 70) interactive television instructors. Many of the respondents were referred to this study by the authors cited in the literature review. Each author was contacted via electronic mail and asked to refer interactive television instructors for the study. This process yielded 288 possible survey respondents throughout the United States.

The typical educator in this study had been teaching for 17.8 (SD = 10.1) years, had been teaching via interactive television for 4.0 (SD = 4.5) years, and had taught 6.4 (SD = 13.8) interactive television courses, including repeated courses. Sixty-four percent (N = 99) of the interactive television instructors reported working with two-way audio and video technology and 36% (N = 57) reported working with two-way audio and one-way video technology. In terms of academic rank, 34% (N = 53) of the sample reported being professors, 32% (N = 50) reported being associate professors, 18% (N = 29) reported being assistant professors, 8% (N = 12) reported being instructors/lecturers, and another 8% (N = 13) reported being adjuncts or other types of appointment.

Collection of Data

Respondents were mailed a personalized cover letter requesting their assistance along with two sets of surveys, one for the traditional face-to-face classroom and the other for the live, interactive television classroom. To be eligible to participate, distance educators needed to currently teach or have taught in both the traditional face-to-face and interactive television classrooms. Of the total 288 survey packets that were initially mailed, 157 were returned, yielding a return rate of 55%.

Both sets of surveys were identical, except for the instructional context. One survey was for the traditional face-to-face classroom and the other was for the interactive television classroom. Both surveys contained measures of student nonverbal responsiveness, student impressions, teaching effectiveness, teaching satisfaction, perceptions of teacher-student interpersonal relationship, selective teaching venue preference along with a variety of other demographic questions.

Measures

Two measures of student nonverbal responsiveness were administered in this study. The first is considered a high-inference measure while the second is considered a low-inference measure. High-inference instruments measure a more gestalt or global perception of student nonverbal responsiveness. Low-inference instruments measure perceptions of students' individual nonverbal responsive behaviors. There are two reasons for using both the high and low-inference measures. First, some of the respondents teach in interactive television instructional settings that do not allow for two-way video transmission. In these conditions, only the vocalic or audible nonverbal cues (i.e., vocal

assurances, starters, inflections, tone, pitch, rate, volume) from the low-inference measure can be assessed. A high-inference measure may also be more appropriate in these conditions since it is believed that interactive television instructors can still detect overall student nonverbal responsiveness via vocalic or audible cues.

The second reason for using both high and low-inference measures is that recall data may be more accurately obtained with a global, high-inference assessment, especially if respondents are recalling student behaviors from previous classes or any classes where some time delay has occurred (Rubin, Palmgreen, & Sypher, 1994, p. 239). Both measures are new to this study and the following paragraphs review their internal reliability assessments and factor structures.

High-inference student nonverbal responsiveness measure. Respondents were asked to assess their students' overall nonverbal responsiveness in a class they currently teach or most recently taught using a four-item, bi-polar measure containing the following adjective pairs: Responsive/Unresponsive, Alert/Not Alert, Attentive/Inattentive, Expressive/Nonexpressive. These adjectives were taken from the literature that defines and describes nonverbal responsive behaviors. The Chronbach alphas, means, standard deviations, and ranges for this and all subsequent measures are reported in Table 1.

Insert Table 1 about here

Low-inference student nonverbal responsiveness measure. This 14-item measure contains a variety of visual and audible nonverbal behaviors. Items comprising the measure are presented in Figure 1.

Insert Figure 1 about here

Some of the items were patterned after Richmond, Gorham, and McCroskey's (1987) nonverbal immediacy behaviors instrument. This instrument measures teacher immediacy behaviors and has been shown to be correlated with a responsive socio-communicative or social style (Thomas et al., 1994). Other responsive items were generated after observing and interviewing interactive television instructors including audible nonverbal behaviors or vocalics such as vocal assurances, starters, inflections, tone, and pitch. Respondents were asked to indicate on a scale from zero to four how often they *saw* or *heard* their students engaging in these individual nonverbal behaviors with zero indicating "Never" and four indicating "Very Often."

Anticipating a two-factor solution (visual and audible nonverbal cues), two internal reliability assessments were conducted. Chronbach alphas and other scale data are reported in Table 1. It should be noted that whenever the nine nonverbal *visual* items were assessed for internal reliability in the interactive television condition, 36% ($N = 57$) of the sample was deleted from the analysis. These instructors reported working with two-way audio and one-way video technology that does not allow instructors to perceive students' *visual* nonverbal responsive cues. Interactive television instructors working in

this condition were instructed to indicate "Never" for the nine nonverbal visual items. These instructors were eliminated from the assessment to avoid inflating the measure's internal reliability. The reported Chronbach alphas for the nonverbal visual items in the interactive television condition were computed with an $\underline{N} = 99$.

When the 14 items were subjected to two separate factor analyses, one for the face-to-face classroom and the other for the interactive television classroom, a two-factor solution was yielded. Before rotating the theorized two-factor solution in the face-to-face classroom, the unrotated pattern was examined. All 14 items, except for item 1, had their heaviest loadings on the first factor, suggesting that the two theorized factor solutions (with the exception of one item) may be collapsed into a single factor. However when the items were rotated, a clear two factor solution with eigenvalues greater than one emerged. The first factor accounted for 43% of the variance and the second factor accounted for 9% of the variance. The two factors were positively correlated at .53. Factor loadings can be seen in Table 2.

Although not all of the items comprising the first nonverbal visual factor (items 1, 2, 3, 4, 5, 6, 7, 8, 9) met the 50/30 criterion for a factor solution, items 2, 5, 6, and 8 were retained because they enhanced the internal reliability of the measure. With the exception of item 9, the other items had their heaviest loadings on the intended factor which was another reason for retaining the items. Item 9, "gesturing with their hands and arms while they were talking to you," loaded for some unexplained reason on the audible nonverbal factor. This item, which is being considered an artifact, was retained because, on its face

value, it clearly reflects a visual nonverbal gesture. The second nonverbal audible factor (items 10, 11, 12, 13, 14) met the 50/30 criterion for a factor solution.

Insert Table 2 about here

The second factor analysis involved the same 14 items, this time completed in the interactive television classroom. Before subjecting the 14 items to the factor analysis, 36% ($\underline{N}$ = 57) of the sample was deleted from the analysis for reasons (indicated above) related to internal reliability assessments. Before rotating the theorized two-factor solution, the unrotated pattern was examined, revealing some variability in the results which may be partially explained by the reduced sample size. All remaining items, except item 11, had their heaviest loadings on the first factor. This suggests that the two theorized factor solutions may be collapsed into a single factor with the exception of item 11. When the items were rotated, however, a clear two-factor solution with eigenvalues greater than one emerged. The first factor accounted for 42% of the variance and the second factor accounted for 13% of the variance. The two factors were positively correlated at .43. Factor loadings can be seen in Table 2.

In the interactive television condition, the analysis yielded factor solutions that met the 50/30 criterion with the exception of three items (1, 8, 13). The first nonverbal visual factor includes items 1, 2, 3, 4, 5, 6, 7, 8, and 9. In the interactive television condition, item 1 failed to load on either factor because students are not always required to raise their hands to speak. Instead they indicate their willingness to speak by activating

the microphone at their remote location. The item was retained because it did not detract from the internal reliability assessment and because it was needed in the face-to-face condition. As with item 9 in the face to face condition, item 8 appears to be an artifact in the interactive television condition. This item (sitting up and leaning forward in their chairs) was retained because on its face value it clearly represents a nonverbal visual cue, and it had its heaviest loading on the intended factor. The second factor, which is the nonverbal audible factor, includes items 10, 11, 12, 13, and 14. Although item 13 did not meet the 50/30 criterion, the item was retained because its heaviest loading was on the intended factor and it enhanced the internal reliability assessment.

These analyses provide statistical support for using the nine nonverbal visual items and the five nonverbal audible items as two separate measures of nonverbal responsiveness. Scale means, standard deviations, and ranges are reported in Table 1.

Additional measures. Five other measures were developed for this study. Each five-item measure contained bi-polar adjectives separated by seven numbers. Respondents were asked to circle the number that most accurately reflected their judgment or evaluation of the concept/idea. The measure assessing student impressions (RQ 2) included the following five bi-polar adjective pairs: Good/Bad, Interested/Not Interested, Intelligent/Not Intelligent, Bright/Not Bright, Positive/Negative. The measure assessing teaching effectiveness (RQ 3) included Effective/Ineffective, Efficient/Inefficient, Skilled/Unskilled, Capable/Incapable, Successful/Not Successful. The measure assessing teaching satisfaction (RQ 4) included Satisfied/Unsatisfied, Pleased/Not Pleased, Happy/Sad, Gratified/Ungratified, Fulfilled/Unfulfilled. The

measure assessing teacher-student interpersonal relationships (RQ 5) included Good/Bad, Warm/Cold, Close/Distant, Shallow/Deep, Comfortable/Uncomfortable.

Finally, the measure assessing selective preference of teaching venue (RQ 6) had slightly altered wording depending on the instructional context. For example, respondents completing the survey in the face-to-face instructional context were asked to indicate how likely it would be for them to select the face-to-face classroom over the interactive television classroom. Identical bi-polar adjective pairs were used in both forms of the measure including Likely/Unlikely, Possible/Impossible, Probable/Improbable, Would/Would Not, Desirable/Undesirable. Chronbach alphas, means, standard deviations, and ranges for all five measures are listed in Table 1. It should also be noted that the additional measures, including the High-Inference Student Nonverbal Responsiveness Measure, were subjected to individual factor analyses where all scale items loaded onto a single factor with eigenvalues greater than one.

Data Analyses

Research questions one and seven were analyzed by computing tests of significant difference to compare means. The amount of variance for each test of significant difference was computed using the omega squared statistic. Research questions two through six were analyzed by computing Pearson Product-Moment correlations using the high and low-inference nonverbal responsiveness measures with the other additional measures.

Results

Research Question One asked if there were significant differences in teachers' perceptions of students' nonverbal responsiveness between traditional face-to-face and interactive television classrooms. Means, *t*-values, significance levels, and variance accounted for by the classroom context (face-to-face or interactive television) are presented in Table 3.

Insert Table 3 about here

All of the nonverbal responsiveness measures yielded significant mean differences between the traditional face-to-face and interactive television classrooms, with nonverbal responsive means in the interactive television classroom being significantly lower than means in the traditional face-to-face classroom. The most significant impact was that of the nonverbal visual measure, which accounted for 40% of the variance in the instructional context.

Research Question Two explored the relationship between teachers' perceptions of their remote/distance students' nonverbal responsiveness and their impressions of their students. The results from this analysis are presented in Table 4.

Insert Table 4 about here

All measures of nonverbal responsiveness were positively correlated with student impressions. In both instructional contexts, as instructors' perceptions of students' nonverbal responsiveness increased, so did the positiveness of their impressions of the students. The largest impact was that of the high-inference nonverbal responsiveness measure in the interactive television context where 42% of the variance in the correlation between nonverbal responsiveness and student impressions were attributable to instructors' perceptions of their students' nonverbal responsiveness.

Research Question Three explored the relationship between teachers' perceptions of their remote/distance students' nonverbal responsiveness and their evaluations of their teaching effectiveness. The results from this analysis are presented in Table 5.

Insert Table 5 about here

Nonverbal responsiveness was positively correlated with instructors' evaluations of their teaching effectiveness in both instructional contexts. As instructors' perceptions of students' nonverbal responsiveness increased, so did their evaluations of their teaching effectiveness. In the interactive television context, it appears that the largest impact was with both the high-inference measure, which accounted for 25% of the variance in the relationship, and with the audible nonverbal responsiveness measure which accounted for 21% of the variance in the relationships between nonverbal responsiveness and evaluations of teaching effectiveness.

Research Question Four explored the relationship between teachers' perceptions of their remote/distance students' nonverbal responsiveness and their teaching satisfaction. The results from this analysis are presented in Table 6.

Insert Table 6 about here

In both instructional contexts, nonverbal responsiveness was positively correlated with teaching satisfaction. Specifically, as teachers perceived their students being more nonverbally responsive, they also reported being more satisfied with their teaching. Correlations were slightly stronger in the traditional face-to-face classroom than in the interactive television classroom. In the interactive television context, it appears that the largest impact was again with both the high-inference measure, which accounted for 24% of the variance in the relationship, and with the audible nonverbal responsiveness measure which accounted for 18% of the variance in the relationships between nonverbal responsiveness and teaching satisfaction.

Research Question Five explored the relationship between teachers' perceptions of their remote/distance students' nonverbal responsiveness and their perceptions of the interpersonal relationships they have with their students. The results from this analysis are presented in Table 7.

Insert Table 7 about here

Nonverbal responsiveness was positively correlated with instructors' perceptions of the interpersonal relationships they have with their students. With the exception of the nonverbal visual measure, the other measures of nonverbal responsiveness were more strongly correlated in the interactive television classroom than in the traditional face-to-face classroom. As instructors' perceptions of students' nonverbal responsiveness increased, instructors perceived their teacher-student interpersonal relationships as being more warm, close, and comfortable. The impact in the interactive television classroom was considerably larger than in the traditional face-to-face classroom. The largest impact was again that of the high-inference measure, which accounted for 41% of the variance in the correlation, as well as that of the audible nonverbal responsiveness measure, which accounted for 34% of the variance in the correlation between nonverbal responsiveness and teacher-student interpersonal relationships.

Research Question Six explored the relationship between teachers' perceptions of their remote/distance students' nonverbal responsiveness and their wanting to teach in the interactive television classroom. The results from this analysis are presented in Table 8.

Insert Table 8 about here

Instructors' perceptions of students' nonverbal responsiveness were not significantly related to teachers preferring to teach in the traditional face-to-face classroom; however, the relationships were significant in the interactive television classroom. Specifically, as teachers perceived their students being more nonverbally

responsive, they also reported a preference for wanting to teach in the interactive television classroom. The largest impact was that of the high-inference measure, which accounted for 16% of the variance in the relationship, as well as that of the visual nonverbal responsiveness measure, which accounted for 17% of the variance in the relationships between nonverbal responsiveness and instructors' selective preference of teaching venue.

Finally, Research Question Seven examined mean differences in teachers' perceptions of their student impressions, teaching effectiveness, teaching satisfaction, and interpersonal relationships between students in the traditional face-to-face and interactive television classrooms. Preference for teaching venue was also included in this analysis. Means, t-values, significance levels, and variance attributable to classroom context (face-to-face or interactive television) are presented in Table 9.

Insert Table 9 about here

With the exception of the student impressions measure, all mean scores on the other various measures between the two classrooms were significantly different from means in the traditional face-to-face classroom being significantly higher than in the interactive television classroom. Specifically, instructors indicated that they were more effective as teachers, more satisfied with teaching, and had better interpersonal relationships with their students in the traditional face-to-face classroom than in the interactive television classroom. When given a choice between the two instructional

classrooms, teachers indicated a significant preference for the traditional classroom. Instructional context had the largest impact on instructors' perceptions of teacher-student interpersonal relationships. The teaching context accounted for 39% of the variance in how teachers perceived their interpersonal relationships with their students.

Follow-up test. Because of the exploratory nature of this research, a follow-up test was conducted to examine the interactive television condition to see how much variance in the measures was attributable to the interactive capabilities of the medium. An analysis of variance was conducted to assess the impact the technology had on distance teaching with the interactive capabilities of the medium (two-way audio/visual, two-way audio/one-way visual) serving as the independent variable and the various instructional measures serving as dependent variables. The means, F-ratios, significance levels, and variance attributable to the interactive capabilities of the technology are presented in Table 10.

Insert Table 10 about here

With the exception of the selective preference of teaching venue measure, all mean scores on the other various measures between the two interactive conditions in the television classroom were significantly different with means in the two-way audio/video condition being significantly higher than in the two-way audio/one-way video condition. Specifically, interactive television instructors perceived more of their students' nonverbal responsive behaviors, formed more positive student impressions, evaluated themselves as

being more effective and satisfied as distance teachers, and perceived better teacher-student interpersonal relationships in the two-way audio/video condition than in the two-way audio/one-way video condition. The largest impact was that of the nonverbal responsiveness measures and the teacher-student interpersonal relationship measure. The interactive capabilities of the technology accounted for 13% of the variance in the high-inference nonverbal responsiveness measure and 14% of the variance in the low-inference nonverbal audible measure. Additionally, the interactive capabilities of the technology accounted for 13% of the variance in the teacher-student interpersonal relationship measure.

Conclusions

With more and more institutions of higher education investing large sums of money in instructional technologies that will allow them to compete in the distance education marketplace, there is a growing demand for distance teaching (Cotton, 1995). Rapid expansion of these initiatives and the comparatively small body of research examining how to teach at a distance (Dillon & Walsh, 1992) gave rise to this study that examined interactive television instructors' perceptions of students' nonverbal responsiveness and how these perceptions influence the distance teaching process.

Three general conclusions can be drawn from the data analyses. The first is that although many distance education programs promote their interactive technologies as being able to simulate the face-to-face classroom, the data suggest otherwise in terms of capturing and transmitting nonverbal responsive cues that have been shown to be important sources of information to teachers (Brooks & Woolfolk, 1987). The data from

Table 3, which compared teachers' perceptions of students' nonverbal responsiveness between the traditional face-to-face and interactive television classrooms, reveal a significant decrease in interactive television instructors' abilities to perceive distance students' nonverbal responsiveness. The data also suggest that interactive television technologies may do a slightly better job capturing and transmitting audible nonverbal cues than visual nonverbal cues. These findings remain consistent with other research that indicates a filtering out of important communication cues when communication is electronically mediated (Culnan & Markus, 1987).

The data presented in Table 10, which examined mean differences on all measures in the interactive television classroom between two-way audio/video and two-way audio/one-way video delivery systems, also support the explanation that nonverbal responsive cues may get filtered out or dulled during electronic mediation. These data suggest that the number of channels (audio, video) used to transmit messages and that allow for full interactivity between teachers and students play an important role in how interactive television instructors perceive their distance students and the teaching process. With the exception of the selective preference of teaching venue measure, mean scores for all other measures were significantly higher in the two-way audio and video condition than in the two-way audio and one-way video condition.

Particularly salient to this research was the 14% variance in the nonverbal audible measure that was attributed to the interactive capabilities or the number of channels used to receive messages from distance learners. Both conditions (two-way audio/video and two-way audio/one-way video) allowed for the transmission of *audible* cues from

distance learners; however when *visual* cues were added, interactive television instructors reported hearing more of the nonverbal *audible* messages. Not only are nonverbal visual cues important sources of information for interactive television instructors, but they also seem to enhance instructors' perceptions of students' nonverbal audible cues.

The second conclusion is that interactive television instructors' perceptions of students' nonverbal responsiveness are positively related to their impressions of students, their perceptions of their teaching effectiveness and satisfaction, their perceptions of teacher-student interpersonal relationships, and their preference for teaching in the interactive television classroom as opposed to the face-to-face classroom. Perceptions of students' nonverbal responsiveness are most influential in how instructors perceive the interpersonal relationships they have with their students. Additionally, audible nonverbal cues account for more of the variance in the relationships with teaching effectiveness, teaching satisfaction, and teacher-student interpersonal relationships in the interactive television condition when compared with visual nonverbal cues. This suggests that being able to detect students' vocal inflections, vocal starters, vocal assurances, and vocal variety such as tone, pitch, rate, and volume are more important sources of information for interactive television instructors in evaluating their teaching effectiveness, teaching satisfaction, and teacher-student interpersonal relationships than students' visual nonverbal responsive cues.

The third conclusion is that instructors' perceptions and evaluations of teaching effectiveness, teaching satisfaction, teacher-student interpersonal relationships, and selective preference of teaching venue tend to be higher in the traditional face-to-face

classroom than in the interactive television classroom. Two findings remain particularly salient. Almost 40% of the variance in the teacher-student interpersonal relationship variable and 31% of the variance in the selective preference of teaching venue variable were attributed to instructional context. This variance becomes especially problematic for administrators who are trying to attract and retain interactive television instructors. Compounding this administrative concern is the fact that the U. S. Congress Office of Technology Assessment (1989) reported that "virtually every state is interested in using telecommunications to serve education, actively planning for distance education, already administering a statewide plan or system, or has local distance learning projects in place" (p. 155). The significant mean differences in the teaching variables coupled with the aforementioned positive correlations also reveal how perceiving fewer students' nonverbal responsive cues may be *one* of the contributing factors to lower evaluations and preferences for teaching in the interactive television classroom.

Implications for Interactive Television Teachers

Three implications for interactive television teachers were yielded from this study. It is hoped that these implications can be integrated into new or existing teacher education curricula specifically designed for interactive television teachers.

The first implication focuses on distance teachers having realistic expectations. Interactive television instructors need to be informed before teaching a class via interactive technology that they will have less control over the delivery of their courses. Additionally, they need to be informed how the presence or lack of student nonverbal responsiveness may influence their teaching and the quality of their teacher-student

interpersonal relationships. Instructors need to be prepared to teach in electronically mediated environments where student nonverbal cues remain minimal. They need to be aware that the lack of student nonverbal responsiveness may not accurately reflect the quality of their instruction, but rather be a partial filtering-out effect of electronic mediation. Instructors need to understand that it may be impossible for them to replicate or control the responsiveness found in the traditional face-to-face classroom in the interactive television context. They need to understand that their inability to simulate the traditional classroom should not completely alter how they perceive their teaching effectiveness as distance teachers.

The second implication centers on the distance learner. It has been suggested that distance teachers need to familiarize distance learners with the instructional technologies that are used in the interactive television classroom (Comeaux, 1995; McHenry & Bozik, 1995). This study's findings indicate that it might also be beneficial to inform distance learners of how important their nonverbal behaviors are to distance teachers and how they use student nonverbal behavior as important sources of information in forming student impressions and evaluating teaching effectiveness and satisfaction. Distance learners also need to understand how media filter out and dull important nonverbal messages. This type of information will not only aid them in regulating their own nonverbal behavior, but will aid them in perceiving and interpreting their distance teachers' nonverbal behavior.

The third implication suggests that distance teachers develop a keen sense of listening. As one distance educator mentioned in Mottet (1998a), "Listening helps you

see your students" (p. 18). The data from this study suggest that nonverbal audible cues such as vocal starters, vocal assurances, vocal variety, and vocal inflections remain important sources of information for distance teachers and may be more important than nonverbal visual cues. By developing listening skills, distance teachers can detect students' affective or emotional meanings via their nonverbal audible messages and adapt and modify instructional communication accordingly. Additionally, it is suggested that distance teachers work closely with administrators who procure distance education delivery systems to insure that new interactive technologies effectively capture and transmit both audible and visual nonverbal messages.

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Table 1

Chronbach Alphas, Means, Standard Deviations, and Ranges for all Measures

	Face to Face Classroom				Interactive TV Classroom			
Measure Type	Alpha	Mean	SD	Range	Alpha	Mean	SD	Range
High Inference	.84	22.1	3.35	9-28	.92	19.8	5.14	4-28
Low Inference								
Visual	.83	27.0	4.42	14-36	.85	22.2	6.20	5-34
Audible	.85	14.1	3.07	7-20	.87	12.1	4.45	0-20
Impressions	.89	28.4	4.64	15-35	.86	28.2	4.63	15-35
Effectiveness	.87	29.2	3.94	15-35	.92	27.4	5.27	12-35
Satisfaction	.92	29.3	4.63	14-35	.96	25.6	7.10	5-35
Relationships	.84	28.9	3.97	18-35	.92	24.7	5.50	8-35
Venue Preference	.95	28.2	6.40	8-35	.96	19.4	8.22	5-35

Figure 1

Nonverbal Visual and Audible Responsive Items

How often did you see your students in the face-to-face/interactive television classroom. . . .

(Scale: Never = 0, Rarely = 1, Occasionally = 2, Often = 3, and Very Often = 4)

1. raising their hands to talk.
2. displaying facial expressions that reflected their positive attitude.
3. showing interest by taking notes on what you were saying.
4. smiling while talking to you.
5. nodding their heads while you were talking to them.
6. looking at you while they were talking to you.
7. smiling while you were talking to them.
8. sitting up and leaning forward in their chairs.
9. gesturing with their hands and arms while they were talking to you.

How often did you hear your students in the face-to-face/interactive television classroom. . . .

(Scale: Never = 0, Rarely = 1, Occasionally = 2, Often = 3, and Very Often = 4)

10. using vocal inflections that suggested their positive attitude.
11. using vocal starters that suggested they wanted to say something.
12. responding quickly to your questions or comments.
13. using vocal variety such as tone, pitch, rate, and volume that suggested their interests.
14. using vocal assurances that suggested they had received and understood your message.

Table 2

Rotated Factor Loadings of 14 Nonverbal Visual and Audible Responsive Items

Item	Face-to-Face Classroom		Interactive TV Classroom	
	Factor 1	Factor 2	Factor 1	Factor 2
1	57	- 6	23	24
2	69	34	80	21
3	55	15	56	7
4	76	29	87	19
5	68	40	82	11
6	29	26	61	22
7	77	30	83	27
8	50	48	44	24
9	38	50	55	24
10	20	80	28	71
11	11	76	-6	81
12	29	69	19	74
13	21	82	40	78
14	19	74	30	71

Table 3

Nonverbal Responsiveness Tests of Significant Difference Between Face-to-Face and Interactive Television Classrooms

Variable	Face-to-Face Means	Interactive TV Means	t-Value	Sig.	w^2
High-Inference	22.07 (157)	19.83 (143)	4.44	.0001	.12
Low-Inference					
Visual	27.03 (156)	22.22 (92)	7.96	.0001	.40
Audible	14.12 (153)	12.07 (150)	5.76	.0001	.18

Note: N values in parentheses.

Table 4

Correlations Between Teachers' Perceptions of Students' Nonverbal Responsiveness and Student Impressions

	Face-to-Face				Interactive Television			
Nonverbal Responsiveness	r	N	Sig.	R^2	r	N	Sig.	R^2
High Inference	.59	146	.0001	.35	.65	139	.0001	.42
Low Inference								
Visual	.43	149	.0001	.18	.42	89	.0001	.18
Audible	.46	146	.0001	.21	.40	144	.0001	.16

Table 5

Correlations Between Teachers' Perceptions of Students' Nonverbal Responsiveness and Evaluations of Teaching Effectiveness

	Face-to-Face				Interactive Television			
Nonverbal Responsiveness	r	N	Sig.	R^2	r	N	Sig.	R^2
High Inference	.57	148	.0001	.32	.50	137	.0001	.25
Low Inference								
Visual	.41	151	.0001	.17	.27	89	.0001	.07
Audible	.36	148	.0001	.13	.46	143	.0001	.21

Table 6

Correlations Between Teachers' Perceptions of Students' Nonverbal Responsiveness and Teaching Satisfaction

	Face-to-Face				Interactive Television			
Nonverbal Responsiveness	r	N	Sig.	R^2	r	N	Sig.	R^2
High Inference	.60	148	.0001	.36	.49	140	.0001	.24
Low Inference								
Visual	.42	151	.0001	.18	.27	90	.0100	.07
Audible	.35	148	.0001	.12	.42	146	.0001	.18

Table 7

Correlations Between Teachers' Perceptions of Students' Nonverbal Responsiveness and Perceptions of Teacher-Student Interpersonal Relationships

	Face-to-Face				Interactive Television			
Nonverbal Responsiveness	r	N	Sig.	R^2	r	N	Sig.	R^2
High Inference	.58	150	.0001	.34	.64	139	.0001	.41
Low Inference								
Visual	.44	153	.0001	.19	.35	89	.0007	.12
Audible	.40	150	.0001	.16	.58	146	.0001	.34

Table 8

Correlations Between Teachers' Perceptions of Students' Nonverbal Responsiveness and Instructors' Selective Preference of Teaching Venue

	Face-to-Face				Interactive Television			
Nonverbal Responsiveness	r	N	Sig.	R^2	r	N	Sig.	R^2
High Inference	.09	147	.2644	.008	.40	138	.0001	.16
Low Inference								
Visual	.08	149	.3426	.006	.41	90	.0001	.17
Audible	.04	146	.6409	.002	.30	144	.0003	.09

Table 9

Tests of Significant Difference Between Face-to-Face and Interactive Television Classrooms

Variable	Face-to-Face Means	Interactive TV Means	t-Value	Sig.	w^2
Impressions	28.37 (150)	28.16 (151)	.49	.6222	.00
Effectiveness	29.16 (152)	27.42 (150)	4.72	.0001	.13
Satisfaction	29.26 (152)	25.58 (153)	6.34	.0001	.21
Relationships	28.91 (154)	24.66 (153)	9.86	.0001	.39
Preference	28.17 (150)	19.38 (151)	8.36	.0001	.31

Note: N values in parentheses.

Table 10

Means, F-Ratios, and Variance Attributable to Interactive Capabilities of Technology

	2-Way Audio/1-Way Video		2-Way Audio/Video				
Measure	M	SD	M	SD	F	Sig.	R^2
High Inference	17.17	5.03	21.06	4.73	20.21	.0001	.13
Low Inference							
Audible	9.91	4.54	13.35	3.89	24.20	.0001	.14
Impressions	26.39	4.91	29.13	4.20	12.97	.0004	.08
Effectiveness	25.64	4.82	28.34	5.28	9.51	.0024	.06
Satisfaction	23.09	6.41	26.95	7.14	11.01	.0011	.07
Relationships	22.07	5.20	26.13	5.14	21.81	.0001	.13
Preference	17.77	8.22	20.25	8.17	3.13	.0789	.02

Note: N = 57 for 2-way audio/1-way video, N = 99 for 2-way audio/video